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ADVANCED PASSIVE SOLAR TECHNOLOGY: THE WINDOW MARKET IN THE UNITED STATES AND CANADA - JANUARY 1986

Canada

ADVANCED PASSIVE SOLAR TECHNOLOGY:
THE WINDOW MARKET IN
THE UNITED STATES AND CANADA

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SECOR Inc.

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EXECUTIVE SUMMARY

The North American market for windows in 1984 totalled approximately 1 160 million sq ft and is not expected to grow more than 5% by the year 2001.

Canada

The overall market for windows in Canada in 1984 was approximately 57 million sq ft of glass[1].

- 45 million sq ft were used by the residential sector,
- 12 million went toward the non-residential sector.

The overall perimeter which this window area represents varied between 44 million ft and 64 million ft. for 1984.[2]

The window market in Canada is expected to grow over the long term; however, window sales to new residential construction are expected to drop substantially from 22 million sq ft to 18 million sq ft as housing starts decline by a projected 55% between 1984-2001.

The renovation and retrofit market which accounts for 45% of total residential window sales is expected to grow steadily over the next 15 years and represents close to 70% (35-43 million sq ft) of the total residential window market by the year 2001.

1 The Canadian market in 1984, is 1/20th the size of the U.S. market. This is partly because the U.S. recovered from the recession much faster than Canada and partly because of tax incentives that exist in the U.S. towards owning property, both residential and non-residential which encouraged more starts.

2 Average window size measured 3 ft x 6 ft. To calculate the overall perimeter a 3 ft x 4 ft window was used as the lower limit and a 3 ft x 6 ft window as the upper limit.

The market for sunspaces is not expected to rise dramatically and is most prevalent in the higher-income-bracket houses. The total market for sunspaces in Canada up to the year 2000 is expected to be 125,000 units.

In 1984:

- 9 million sq ft of glass were used for windows in new non-residential construction in Canada and
- 3 million for renovation and retrofit.

The non-residential demand for windows is expected to range between 12 to 14 million sq ft by the year 2001. Forecasts indicate that by the year 1991:

- the commercial sector's market share is expected to increase by about 3% by the year 1991, whereas;
- institutional and other buildings only about 1% .

Renovation activity in the non-residential sector is expected to increase modestly; however, the gains will not come close to matching those of the residential renovation sector.

United States

The overall market for windows in the United States for 1984 was estimated at 1,103 million sq ft

- 888 million sq ft were used in the Residential sector; and,
- 215 million sq ft in the non-residential sector.

The overall of perimeter which this window area represents used varied between 858 million ft and 1,225 million ft, in 1984.

Unlike Canada, the total new residential construction in the U.S. has increased steadily over the last few years:

- 585 million sq ft of glass were used for prime windows in the residential construction market, whereas;

- 313 million sq ft of glass were used for storm windows in the same market.

Prime window sales are not expected to increase substantially by the year 1995; however, storm windows which are primarily used for remodeling and replacement purposes are expected to increase their share from 45% to 50% of the total residential market by the year 1995. A rough estimate of prime window sales is as follows:

- 374 millions sq ft, to the new residential market in 1995, whereas;
- the renovation market is expected to grow to approximately 325 million sq ft by 1995.

1984 was a healthy year for the U.S. non-residential construction sector, where:

- 117 million sq ft of glass were used in new non-residential construction, and;
- 98.8 million sq ft for the renovation and alterations market.

Forecasts indicate that industrial construction is likely to be the fastest growing market over the next five years; estimates by the Drucker Research company point to sales of 137.6 million sq ft in remodeling and replacement applications by the year 1987.

The market for sunspaces both in Canada and the United States is very sketchy and is usually divided into contractor-built and owner-built. The total market for sunspaces in the United States, up to the year 2000, is expected to be 2.5 million units of which 40% are already in place.

I. INTRODUCTION

INTRODUCTION

The purpose of this report therefore, is to document the existing window market from available industry statistics;

- Firstly to identify the window market for residential buildings;
- Secondly to identify the window market for other building types based on available estimates of demand by building type, and lastly to
- Estimate the market for attached sunspaces by type of structure.

This research was accomplished over a period of ten weeks and commenced in October 1985. The objective was to compile existing data in order to sketch a reasonable picture of the window market to help in identifying the scope of the opportunities available for super-window technology. Thus, the statistics presented in this report are by no means the final word on the highly dispersed and fragmented window industry.

Documented statistics were gathered and the existing players (manufacturers, suppliers and experts) in both the residential and non-residential construction sectors were contacted to provide Government and business with as accurate an estimate as possible of the window market in North America.

The information in this report has been organized under three main headings:

- The residential sector, which provides a market profile of Canada and the U.S. for both new construction and renovation and retrofit by type of dwelling as well as their long-term trends;
- The non-residential sector, which also provides a market profile of Canada and the U.S. for new construction and renovation and retrofit by type of structure and their long-term trends; and lastly,
- The market for sunspaces both in Canada and the U.S. along with their forecast by type of structure.

II. RESIDENTIAL WINDOW MARKET

MARKET PROFILE (CANADA)

RESIDENTIAL CONSTRUCTION

- The residential construction industry represents an important but declining part of the Canadian economy.

- 1976 was a high point for residential construction. That year it accounted for:

  - 6.6% of Canada's GNP and
  - 38.2% of all construction.

- In 1984 residential construction accounted for:

  - 4.0% of Canada's GNP and
  - 30.0% of all construction.

New residential construction (starts)

- All dwelling types have experienced a reduction in new construction over the past few years. Declines were particularly pronounced over the 1981-1982 period due to recessionary impacts. Although some recovery was evidenced by 1984, construction starts in all sectors were still below 1980 levels.

    - The largest decline over the 1980-1984 period was registered by semidetached starts which fell by almost half.

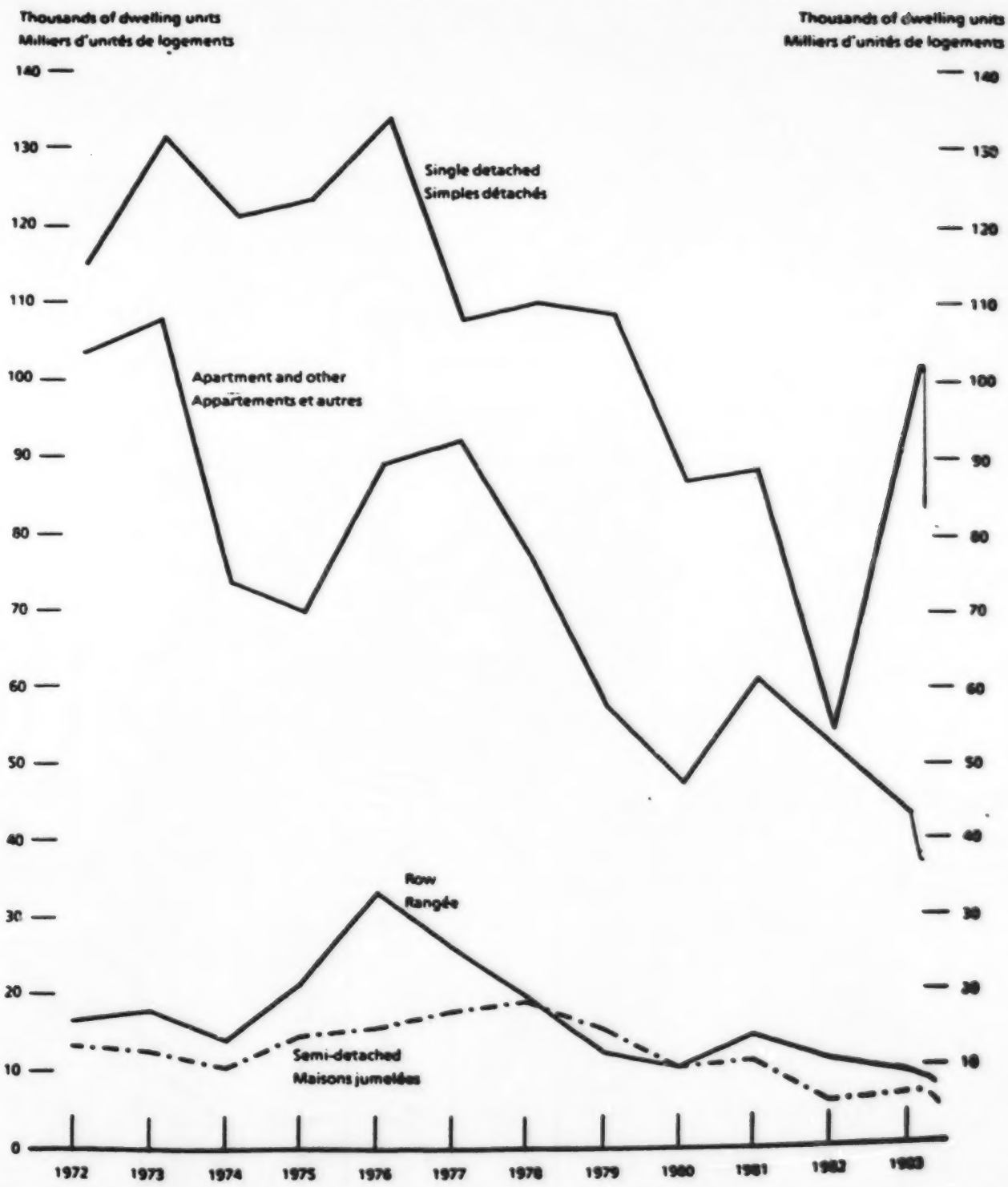
New Residential Construction
1980 - 1984
(000 units)

Starts (000)	1980	1981	1982	1983	1984
Single detached	88	89	54	102	84
Apartment and other*	48	62	53	44	37
Row	11	16	12	10	8
Semidetached	11	12	6	7	6
Total	158	179	125	163	135

Source: Statistics Canada
Figures rounded to nearest (000)

* Separate statistics are not provided for mobile homes because in Canada, unlike the U.S., they represent a very small specialized market.

Residential Construction, Starts, by Type of Dwellings, 1972-1983



Source: Statistics Canada - Marker Research Hard Book 1984

Regional Distribution of New Residential Construction (starts)

- Over the last few years the majority of new residential construction has taken place in central Canada.

  - In 1984, 67% of national starts were in Ontario and Quebec, 23% more than in 1980.
  - The magnitude of this increase can be attributed to the stronger economic growth in central Canada and a reversal of the migratory trends in 1980 when the region was losing population, principally to British Columbia and Alberta.

Housing Starts by Province
1980-1984

TOTAL STARTS:					
	1980	1981	1982	1983	1984
Newfoundland	3,800	3,200	2,800	3,300	2,700
Prince Ed.Island	500	200	200	700	700
Nova Scotia	3,900	3,700	3,700	5,700	4,600
New Brunswick	2,600	2,200	1,700	4,700	2,800
Quebec	29,200	29,600	23,500	40,300	42,000
Ontario	40,100	50,200	38,500	54,900	48,200
Manitoba	2,600	2,800	2,000	6,000	5,300
Saskatchewan	6,300	6,000	6,800	7,300	5,300
Alberta	32,000	38,500	26,800	17,100	7,300
British Columbia	37,500	41,900	19,800	22,600	16,200
Total	158,500	178,300	125,800	162,600	135,100

PERCENTAGE DISTRIBUTION:					
	1980	1981	1982	1983	1984
Newfoundland	2.4	1.8	2.2	2.0	2.0
Prince Ed.Island	0.3	0.1	0.2	0.4	0.5
Nova Scotia	2.5	2.1	2.9	3.5	3.4
New Brunswick	1.7	1.2	1.3	2.9	2.1
Quebec	18.4	16.7	18.7	24.8	31.1
Ontario	25.3	28.2	30.6	33.8	35.7
Manitoba	1.6	1.6	1.6	3.7	3.9
Saskatchewan	3.9	3.4	5.4	4.5	3.9
Alberta	20.2	21.6	21.3	10.5	5.4
British Columbia	23.7	23.4	15.7	13.9	12.0
Total	100.0	100.0	100.0	100.0	100.0

Source: Statistics Canada
Figures rounded to nearest (00)

WINDOW MARKET IN NEW RESIDENTIAL CONSTRUCTION

- In 1984, approximately 25 million sq ft of glass were used for windows in new residential construction, a drop of 11% over 1980 levels.

  - Single detached starts accounted for 76% of the total area of glass used in new residential construction
  - Apartments for 17%
  - Row houses for 4%
  - Semidetached houses for 3%

Window Market in New Residential Construction
1980 - 1984

Type of dwelling	Total Windows (000 sq ft)				
	1980	1981	1982	1983	1984
Single detached	19,700	19,900	12,100	22,800	18,800
Apartment	5,400	6,900	5,900	4,900	4,100
Row	1,200	1,800	1,300	1,100	900
Semidetached	1,400	1,600	800	900	800
Total	27,700	30,200	20,100	29,700	24,600

Source: Ford Glass Estimates for Window Area by Type of Dwelling:
Single-detached - 224 sq ft
Semidetached - 130 sq ft
Apartment - 112 sq ft
Row - 112 sq ft

Renovation and retrofit

- Renovation activities in residential construction were valued at approximately $7 billion in 1984.

- Investments in residential retrofits have risen as a percentage of total residential investments over the past years. This trend is expected to continue.

  - In 1980, renovation represented 39% of total residential investment whereas,

  - In 1984, renovation increased to 43% of total residential investment.

Value of Renovation Activity (Repairs, Improvements, Conversions)
As a Proportion of Residential Construction
1980 - 1985
(Current $000,000)

Year	Repairs[1]	Alterations[2] Improvements	Total Housing Investment and Repair	Renovations as % of total
1980	2 862	2 637	14 259	38.6
1981	2 229	2 739	16 630	35.9
1982	3 433	2 344	13 724	42.1
1983	3 857	3 031	16 851	40.9
1984	4 044	3 070	16 497	43.1
1985[3]	4 229	3 226	16 912	44.1

Source: CMHC

1 Estimates of non-capital repairs which keep properties in good working condition and appearance. The estimates cover homeowners, landlords and tenants.

2 Includes improvements to cottages and conversions

3 Forecast

- Within the window market, sales for renovation and retrofit activities are roughly at par with sales to the new construction market.

- Results of a 1985 industry survey* covering manufacturers/suppliers, dealers/retailers and insulation contractors of a wide range of products (windows, doors, siding and insulation) indicated that:

  - 60% of industry business was in the renovation market.

- A regional breakdown of the responses further showed that:

  - In Ontario renovation accounted for 65% of volume

  - In the Maritimes 64%

  - In the Prairies 51%

- Based on the above figures and the 43.1% market share allocated to renovation in total residential investment in 1984:

  - Between 45-50% of total residential window sales go to the renovation/retrofit market which totals some 20.0-25.0 million square feet of glass.

* 1985 Industry Survey by Alumi News.

Glazing

- Almost all windows in residential homes have at least a double glazing.
    - The market for single-glazed windows is very small and mainly in Vancouver where the climate is fairly mild. Also the use of single-glazed windows is higher in the do-it-yourself market than in the building contracting industry as a whole.
- It is estimated that in single detached, semidetached and row homes, 75% of window units are made of sealed insulated glass:
    - In apartments this figure is 85%.
    - The remaining windows are storm windows or operating double glazed units.

Sealed Insulated Glass Units
In New Residential Construction
By Type of Dwelling
1980 - 1984

Type of dwelling	Total Insulated Glass (000 sq.ft.)				
	1980	1981	1982	1983	1984
Single detached	14,700	15,000	9,100	17,100	14,100
Apartment & other	4,600	5,900	5,000	4,200	3,500
Semidetached	1,100	1,200	600	700	600
Row	900	1,300	1,000	800	700
Total	21,300	23,400	15,700	22,800	18,900

Source: Statistics Canada, combined with Ford Glass estimates:
Single detached : 224 sq ft per start
Semidetached : 130 sq ft per start
Row & apartment: 112 sq ft per start

- A 1983 IGMAC survey indicates that of insulated glass units being sold to the new residential sector, the majority are double-glazed:

% Distribution of Insulated Glass in New Residential Construction 1983

Product Type	%	Total Insulated Glass (000 sq.ft.)
Double-Glazed Units		
Clear	74	16,872
Tinted and Reflective	4	912
Sub-total	78	17,784
Triple-Glazed Units		
Clear	22	5,016
Tinted and Reflective (Accounts for under 0.1%)		
TOTAL	100	22,800

Source: IGMAC Survey

- The relative weakness of the market for triple-glazed units among home owners can be attributed to cost considerations:

  - While triple-glazed units facing the south are on average 3% - 5% more energy efficient, they are considerably more expensive than double-glazed units and the energy savings generated are not perceived to be great enough to warrant the additional expenditure.[1]

  - Approximately 75% of triple-glazed units are sold in the wealthier Quebec regions and Northeastern Ontario.

  - In the Prairie provinces, the harsh climate leads to a greater relative use of triple glazing. In Manitoba and Saskatchewan up to 50% of windows in homes are triple-glazed.

1 Triple-Glazed units facing the north are considerably more energy efficient.

Frames

- Approximately 90% of windows in single family homes and low-rise residential buildings have wooden frames.

- Of the several window types used in both new construction and renovation in the residential market, horizontal sliders are the most popular. Contractors prefer them for their low cost in spite of their poor energy efficiency:

% Distribution of Window Type in the Residential Market for New Construction and Renovation 1982

Window Type	%
- Horizontal sliders[1]	34.6
- Vertical sliders	4.9
- Casement & awning	8.7
- Other e.g. fixed pane, double hung, rotating window, awning/hopper window etc.	51.8
TOTAL	100

Source: Esso Chemicals (John Cummings) - based on the 1982 market, estimated @ 48.2 million square feet of vision area.

1 Horizontal sliders are usually double glazed

- The material used for the frame varies with the type of window:

% Distribution by Window Type of Frame Material in Residential New Construction and Renovation

1982

Frame Material	Horizontal Sliders	Vertical Sliders	Casement & Awning
Wood	-	-	58%
Wood/Vinyl composite	27	42	-
Wood/Vinyl clad	14	16	24
Wood/Metal clad	7	7	10
Sub-total	48	65	92
Metal	18	1	1
Metal/Vinyl composite	32	30	5
Sub-total	50	31	6
Vinyl	2	4	2
Total *	100	100	100

Source: Esso Chemicals - based on 1982 market, estimated @ 48.2 million square feet of vision area.

* Rounded figures may not add to 100

- 72% of windows in New Construction & Renovation are Horizontal Sliders
- 10% are Vertical Sliders and
- 18% Casement and Awnings

LONG TERM TRENDS

- Demographic factors continue to be the most important influence in residential construction.

  - From 1976-2001, the Canadian population will likely increase by only 22%, one third the rate of the previous quarter century, or an annual increase of 0.8 per cent.

  - Based on these population growth estimates, housing requirements will decrease for the rest of the century. The following figures are CMHC estimates for Canada's average annual new housing requirements:

Canada
Residential (new)
Average Annual Housing Requirements
1986 - 2001
(000 units)

Tenure	1986-91	%	1991-96	%	1996-2000	%
Home ownership	118.2	65	93.5	71	72.0	73
Rental	63.2	35	38.1	29	26.6	27
Total	181.4		131.6		98.6	
Dwelling Type						
Single housing	106.2	59	85.1	64	66.3	67
Semidetached	8.0	4	5.0	4	2.7	3
Row houses	5.5	3	2.6	.9	1	1
Apartments	49.4	27	31.5	24	23.2	24
All other types*	12.3	7	7.4	6	5.5	5
Total	181.4	100	131.6	100	98.6	100
Household Type						
Family	118.0	65	84.5	64	58.0	59
Non-Family	63.4	35	47.1	36	40.6	41
Total	181.4		131.6		98.6	

Source: CMHC

- Projections shown in the above table indicate a reduction in total requirements for additional housing, however the percentage attributed to ownership and single detached houses is expected to increase primarily due to the increasing household formation in the 35-54 age group.

* Separate statistics are not provided for mobile homes because unlike U.S., in Canada they represent a very small, specialized market.

- Starts of all dwelling types are expected to drop by the year 2000:

- However,

  - In the residential construction sector, single detached houses are expected to increase their market share from an average of 54% in 1981-86 to 67% in 1996-2000.

  - Semidetached, row, apartment and other dwellings are projected to experience a fall in market share over the same period.

- The geographic distribution of the future population is difficult to estimate due to the unpredictability of interprovincial migrations. However, if the general trends of recent years continue*:

  - Alberta would be the biggest winner, although the economic downturn caused a reversal in 1983

  - Ontario would keep its numerical advantage over other provinces

- If interprovincial migrations return to their long-term trends:

  - Ontario, Alberta and British Columbia would be the winners

  - The Maritimes, Manitoba and Saskatchewan the losers

* Source: Canada Constructs - Construction Industry Development Council

Window market -
Long term trends

- Following projected trends in the housing industry, window sales to the residential sector for new construction should decline substantially by the year 2000.

  - The amount of glass used for windows in new housing starts will drop to 19 million sq ft from the current level of 25-30 million sq ft. This will represent a decline of almost 30% from current levels.

  - The majority of window sales will continue to be for single detached homes. It is expected that this sector will represent 80% of the window market in new residential construction.

Projected Window Use in New Residential Construction
1986 - 2001
(000 sq ft)

	1986-1991	1991-1996	1996-2001
Single housing	23,789	19,068	14,851
Apartments	5,533	3,528	2,598
Other*	1,599	962	715
Semidetached	1,040	650	351
Row houses	616	291	112
Total	32,577	24,499	18,627

- Assuming sq ft of glass for different dwelling types remains unchanged.
- Based on average housing requirements (CMHC estimates) for the 1981-86 period.

* Includes mobile homes

- The impact of declining residential construction on the window market should be modified by renovation and retrofit expenditures.

  - The overall percentage of housing stock over 40 years old (a current benchmark used to indicate the point at which remedial work can be expected to become necessary) is projected to increase 50% between 1981 and 2001.

  - Based on these figures and the fact that sealed window units have only a 20 year life expectancy, renovation and retrofit activities could account for some 65-70% of the total residential window market by the turn of the century. This renovation and retrofit market represents approximately 35-43 million sq ft of glass.

MARKET PROFILE (U.S.)

New Residential Construction (starts)

- Residential construction starts in 1984 were up 33% over 1980 levels.
  - Private residential construction, including additions and alterations was valued at $78 billion (1977 U.S. dollars).
  - Public expenditures on housing and redevelopment were valued at $11 billion (1977 U.S. dollars).
- Total starts in 1984 were 2.05 million units
  - 1.08 million were single units (53%)
  - 0.67 million were multiple units (33%)
  - 0.30 million were mobile homes (14%)
  - Multi-unit housing construction which did not decline as much as single unit housing during the 1980-82 slump, has increased faster than single-unit housing during the recovery.

New Housing by Type of Structure
Private and Public, including Farm
1980 - 1984
(000 units)

Conventional housing type	1980	1981	1982	1983	1984
Single family	852	705	663	1,067	1,085
Multi family	461	395	409	646	665
Mobile home	222	241	239	296	294
Total	1,535	1,341	1,311	2,009	2,044

Source: AAMA 1984 Statistical Review

Regional Distribution of New Residential Construction (starts)

- Residential construction in the U.S. is concentrated in the South and the West which together account for 74% of the market.

- The distribution of starts over the past five years among the regions has remained fairly stable.

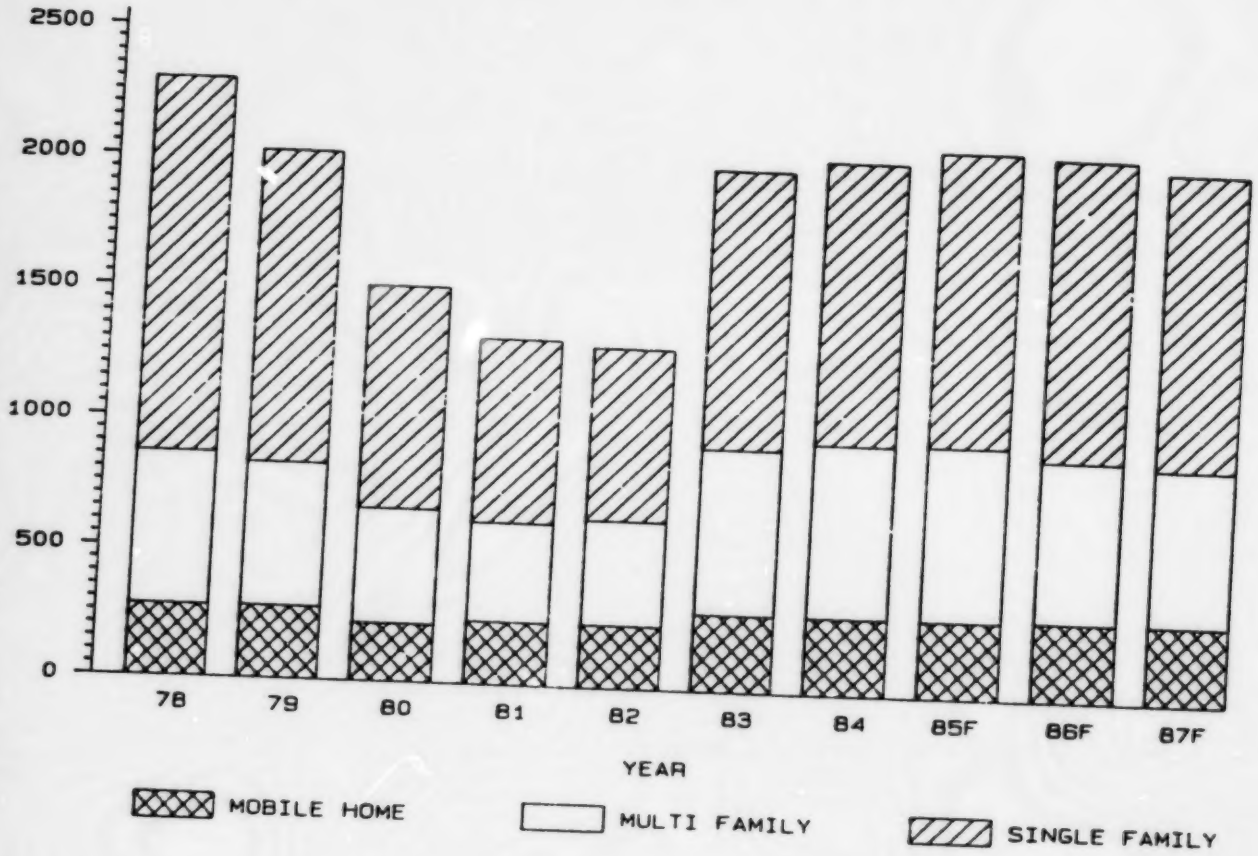
% Distribution of New Conventional Housing by Geographic Region (1980 - 1984)

	1980	1981	1982	1983	1984
Northeast	10	11	11	10	12
North Central	17	15	14	13	14
South	50	52	56	55	49
West	23	22	19	22	25
TOTAL	100	100	100	100	100

Source: AAMA - 1984 Statistical Review

NEW RESIDENTIAL CONSTRUCTION BY TYPE OF STRUCTURE

000'S OF UNITS



Window Market in New Residential Construction (starts)

- Sales of window units to the new housing sector for 1984 were:
  - 329 million sq ft for prime windows, an increase of 14% over 1980 levels
  - 31 million sq ft of storm windows
- Sales fell by almost a third during the recession but have since recovered, surpassing 1980 levels by some 14%.

Sales of Prime Windows
New Residential Construction
1980 - 1984
(000,000 units)

Year	Sales
1984	18.3
1983	17.9
1982	11.0
1981	13.7
1980	16.0

Source: AAMA-1984 Statistical Review

% of Residential Prime Windows by Type of Glazing
1984

Type of Glazing	%
Single	16
Double[1]	71
Triple Glazing or thin-film technology	13

Source: Ducker Research Company
1 Both insulating glass and storm panels

- In mobile homes:
  - o 60% of windows were multiple glazed, with a majority of these consisting of a single lite window with a separate storm window

Renovation and Retrofit

- Total expenditures for residential alterations, additions and repairs were about $65 billion in 1984.* This amount excludes the value of do-it-yourself labor. Of this total:

  - About 40% was for additions and alterations
  - About 35% was for maintenance and repairs
  - About 25% was for major replacements

- Competition in the replacement market has intensified as the established players in the field, aluminum and wood, must now contend with all-vinyl producers.

- Sales of prime windows in residential replacement and remodeling were 256 million sq ft in 1984. Sales of storm windows were 282 million sq ft to replacement and remodeling and 31 million sq ft to new construction.

Sales of Prime Windows and Storm Windows in the Residential Replacement and Remodeling Market
1980 - 1984
(000,000 sq ft)

Year	Prime Windows	Storm Windows*
1984	256	313
1983	245	308
1982	216	270
1981	234	N.A.
1980	198	490

* Includes remodeling (90%) and new construction (10%).
Source: AAMA - 1984 Statistical Review

Glazings

- The type of glazing used varies considerably in the residential market.

Type of Glazing in Residential Prime Windows 1982

Type	%
- Sealed insulating glass	68
- 2 lites of glass, no hermetic seal	6
- Triple glazing	5
- Other e.g. sealed triple glazed, single glazed with storm window, etc.	21
TOTAL	100

Source: Drucker Research Co. The 1982 distribution of glazings was 91% clear glass, 8% tinted, 1% reflective

- The type of glazing used is strongly affected by regional preferences.

  - The concentration of residential construction in the South and the West has considerable impact upon the relative need for solar reflective, dyed, and thermal insulation glass products. Less than 10% of such construction occurs in extreme northern areas i.e. in which triple glazing is required.

  - Insulated glass products account for 90% of all new residential glass installed within the northern states, but only 40% of glass installed within the southern states.

  - Because of their high cost, triple-glazed insulated glass products seem to have penetrated only the extreme northern states, primarily for remodeling purposes.

Frames

- In the new construction market:

  - Aluminum windows account for 58% of the market, up from previous years.

    . Part of this gain can be attributed to construction trends which have shifted from the North which favours wood to the South and West which prefer aluminum.

  - Wood windows account for 39% of the market.

  - Vinyl and other windows have a 3% market share. Vinyl is expected to increase its portion rapidly over the next few years.

New Construction
Sales of Prime Windows
by Type of Frame
1980 - 1984

	Total Window Area (000,000 sq ft)				
Frame Material	1980	1981	1982	1983	1984
Aluminum	144	131.4	108	176.4	192.6
Wood	126	111.6	84.6	136.8	129.6
Vinyl	1.8	1.8	1.8	3.6	3.6
Other	16.2	1.8	3.6	5.4	3.6
Total	288	246.6	198	322.2	329.4

Source: AAMA - 1984 Statistical Review

* Average of 18 sq ft of glass per window unit.

Frames... (cont'd)

- In the renovation and remodeling market in 1984:
  - 57% of windows were aluminum
  - 30% of windows were wood
  - 10% of windows were vinyl
    - Use of vinyl is 9.8% higher in replacement and remodeling applications than in new residential construction.

Renovation and Remodeling
Sales of Windows by Type
of Frame
1980 - 1984

Frame Material	Total Window Area (000,000 sq. ft.)				
	1980	1981	1982	1983	1984
Aluminum	126	138.6	126	142.2	145.8
Wood	57.6	86.4	73.8	82.8	75.6
Vinyl	9	5.4	9	12.6	25.2
Other	5.4	3.6	7.2	7.2	9
Total	198	234	216	244.8	255.6

Source: AAMA - 1984 Statistical Review

- Storm windows in 1984 were 90% aluminum with the balance having wood frames.

LONG TERM TRENDS

- The residential construction market is expected to recover strongly from its depressed condition of the last few years.

- Pent-up demand will spur new home sales as interest rates fall; however, by the late 1980's a slowdown in the rate of new household formation will dampen this demand pressure. The forecasts for residential construction are shown in the following table:

Forecast Gross Private Investment in Residential Construction ($ billion - 1972 dollars)

Forecasted Year	Low Projection	Moderate Projection	High Projection
1990	63.6	80.5	97.8
1995	69.8	78.1	113.1

Source: U.S. Bureau of Labor Statistics

  - The moderate projection of $78.1 billion in 1995 would imply an increase of 106% over 1982 levels.

- Demographic factors will remain among the most important determinants of long-term housing demand.

  - Forecasts of increases in the number of persons entering the 35-44 age group indicate favourable growth for the construction of single-family homes.

  - The 18-25 age group will drop sharply resulting in slack demand for multi-unit housing unless lifestyle and economic factors change

  - The 65 and over age group is growing rapidly but has relatively little direct effect on housing because few in it are frequent home buyers.

- The U.S. Bureau of Labour Statistics projects private housing starts to peak in 1988 at 2.16 million units.

- From 1988-1995 growth will moderate and housing starts will stabilize at 1.9 million

Private Housing Start Projections
1988 and 1995
(000,000 units)

Type	1988	1995
Single-unit	1.43	1.25
Multi-unit	0.73	0.65
TOTAL	2.16	1.90

Source: U.S. Bureau of Labor Statistics

- Mobile homes are projected to grow at an annual rate of:

  - 5.9% between 1982-1990

  - 2.5% between 1990-1995

- The top regional housing markets for residential single-family and multi-family units projected over the next five years occur in California, Florida and Texas:

  - These are areas of considerable solar heat gain and marginal heating load. It is therefore to be expected that habitable and thermally comfortable spaces with reflective and tinted glazings as well as extensive usage of shading devices will have a large market in these areas.

New Residential Construction
Top 25 States - 5 Year Forecast
1985 - 1990

		Projected number of new dwelling units		
		Single family	Multifamily	Total
1	California	68,200	60,800	129,000
2	Texas	70,500	45,500	116,000
3	Florida	60,300	50,700	111,000
4	Arizona	20,000	25,000	45,000
5	Georgia	25,000	15,000	40,000
6	Maryland	30,000	8,000	38,000
7	Colorado	14,000	13,000	27,000
8	Ohio	14,200	7,500	21,700
9	New York	9,000	11,800	20,800
10	Pennsylvania	14,000	6,500	20,500
11	Illinois	11,200	7,200	18,400
12	Minnesota	10,000	5,000	15,000
13	Virginia	9,500	4,300	13,800
14	Missouri	9,000	5,000	14,000
15	Washington	5,500	6,500	12,000
16	Tennessee	6,000	5,000	11,000
17	N. Carolina	6,500	4,000	10,500
18	S. Carolina	6,200	3,800	10,000
19	New Jersey	5,500	4,400	9,900
20	Michigan	5,900	3,800	9,700
21	Massachusetts	5,000	3,000	8,000
22	Louisiana	5,000	3,000	8,000
23	Nevada	5,000	3,000	8,000
24	New Mexico	3,000	4,000	7,000
25	Connecticut	4,000	2,000	6,000
	TOTAL	422,500	307,800	730,300

Source: NAHB ECONOMICS DIVISION; "Five-Year Local Forecast", Builder Magazine, March 1985.

Window Market - Trends

- Forecasts for 1987 indicate that:

  - Sales of prime windows both in new construction and remodeling should register a slight increase with an overall gain of 3.4%.

  - Sales of storm windows should increase by 2.3% over 1984 levels.

Forecast of Prime Window Sales
New Construction and Remodeling
1985- 1987
(000,000 units)

Frame Material	Total Window Area (000,000 sq. ft.)		
	1985	1986	1987
New Construction			
Aluminum	198	198	194.4
Wood	133.2	133.2	131.4
Vinyl	3.6	3.6	3.6
Other	3.6	3.6	3.6
Total	338.4	338.4	333
Remodeling and Replacement			
Aluminum	149.4	147.6	149.4
Wood	79.2	77.4	79.2
Vinyl	28.8	32.4	36
Other	9	9	7.2
Total	266.4	266.4	271.8

Source: AAMA - 1984 Statistical Review

- 1987 forecasts for the distribution of windows by type indicate that:

  - The largest window market will continue to be aluminum windows which will account for roughly 57% of sales.

  - Wood windows will account for 35%.

  - Vinyl and other for 8%.

1987 Forecast:
Residential Construction
% Distribution of Prime Windows
By Type of Frame

Window Type	Total	New Construction	Remodeling & Replacement
Aluminum	57	58	55
Wood	35	40	29
Vinyl	6	1	13
Other	2	1	3
TOTAL	100	100	100

Source: AAMA - 1984 Statistical Review

- Looking further ahead to 1995 a rough estimate on prime window sales to the new residential market in 1995 would be:

  - 374 million sq ft[1].

1 Figures based on private housing start projections (page 26), assuming 13 windows for single homes and 7 windows for multi-unit homes and each unit averaging 18 sq ft of window area.

- For the renovation market it is estimated[1] that the output of maintenance and repair construction (almost 2/3 of which is for residences) will grow by 2.2% a year through 1995 indicating a fairly slow growing but steady market for window renovations. Most of this renovation and retrofit activity over the next two decades will be in the Northern U.S. as a large percentage of housing stock over 40 years old is found there.

- Projection of window types in 1995 would have to take into account the increasing popularity of vinyl windows.

  - Vinyl windows[2] have increased from a total market share of 2% in 1980 to 5% in 1984.

  - In the replacement market, use of vinyl windows is relatively higher having grown from 5-10% over the same period.

1 U.S. Bureau of Labor Statistics

2 Source: AAMA 1984 Statistical Review

III. NON-RESIDENTIAL WINDOW MARKET

MARKET PROFILE: CANADA

NON-RESIDENTIAL CONSTRUCTION

- In 1984, the total value of non-residential building construction was approximately $15 billion dollars, an increase of 17% over 1980 levels.

- Of the 1984 value,
  - Commercial buildings accounted for 47%
  - Institutional buildings accounted for 20%
  - Industrial buildings accounted for 18% and
  - Other buildings accounted for 14%

Total Value of Non-Residential Construction by Building Type
($ 000,000)

Building Type	1980	1981	1982	1983	1984
Industrial	3 000	3 600	3 000	2 500	2 700
Commercial	5 900	7 000	7 100	6 500	7 000
Institutional	2 200	2 600	3 100	3 100	3 000
Other	1 600	2 000	2 100	1 900	2 100
TOTAL	12 700	15 200	15 300	14 000	14 800

Source: Statistics Canada
- Figures rounded to nearest million

WINDOW MARKET IN NEW NON-RESIDENTIAL CONSTRUCTION

- In 1984, approximately 9 million sq ft of glass were used for windows in new non-residential construction.

  - Commercial buildings represented 65% of the total window area in this market
  - Institutional buildings 27%
  - Industrial buildings 8%

WINDOW AREA IN NEW NON-RESIDENTIAL CONSTRUCTION 1982- 1984

BUILDING TYPE	FLOOR SPACE (000 sq ft)			WINDOW AREA (000 sq ft)		
	1982	1983	1984	1982	1983	1984
Commercial	78 100	34 500	36 000	12 500	5 600	5 800
Institutional	21 300	20 900	22 000	2 300	2 300	2 400
Industrial	34 900	13 200	14 000	1 700	700	700
TOTAL	134 300	68 600	72 000	16 500	8 600	8 900

Source: Ford Glass
Commercial : Window area = 16% of floor
Institutional: Window area = 11% of floor
Industrial : Window area = 5% of floor

- If the 60/40 split found in the U.S. between architectural and curtain wall usage in non-residential buildings applies to Canada one can estimate that in 1984:

  - 5.3 million sq ft of glass were used for architectural windows.
  - 3.6 million sq ft of glass were used for curtain walls.

Renovation and Retrofit

- Window renovation and retrofit activities in the non-residential construction sector are much lower than in the residential sector.

- Overall expenditures on repair work in the non-residential sector have decreased slightly since 1980.

Total Value of Construction Work Purchased
1980 1984
($000,000 in constant 1971 $)

Type of construction work	1980	1981	1982	1983	1984
New	17,300	18,500	16,900	16,100	15,800
Repair[1]	3,400	3,300	3,300	3,400	3,500
TOTAL	20,700	21,800	20,200	19,500	19,300

Source: Statistics Canada

Figures rounded to nearest 100,000

1 Repair work does not include major alterations

Glazing and Frames

- It is estimated that usage of sealed insulated glass products in commercial and institutional buildings is 80% of window area.

- Insulated glass usage in industrial buildings is considerably lower accounting for only 25% of window area.

- A 1983 IGMAC survey indicates that of the total production of insulated glass products going to new non-residential construction:

  - 88% were double glazed.

  - 12% were triple glazed.

% Distribution of Insulated Glass in New Non-Residential Construction 1983

Product Type	%
Double Glazed Units	
Clear	48
Tinted and Reflective	40
Sub-Total	88
Triple Glazed Units	
Clear	7
Tinted and Reflective	5
Sub-Total	12
TOTAL	100

Source: IGMAC

- 79% of the total production of tinted and reflective triple glazed units is used in the non-residential sector.

- Only 21% of tinted and reflective triple glazed units is used in residential construction.

- Frame usage in non-residential buildings is approximately 65% aluminum.

Long-term Trends

- The non-residential construction sector is more directly affected than the residential sector by the general economic situation, the level of inflation, the state of the world economy and oil prices.

- Forecasts by the Construction Industry Development Council to the year 1990 indicate:

  • Industrial development in Canada, stimulated by resource development will be stronger throughout the latter half of the decade.

  Real increases will be 5% anually amounting to an overall increase of approximately 35%.

  • Capital investment by the trade, finance and commercial services sector, which declined dramatically in 1982, is forecast to grow only slowly to 1990.

  Assuming a 2% annual growth rate the overall increase in the sector during this period would be 13%.

- The distribution of building construction among the various non-residential sectors will change towards the 1990's reflecting the anticipated economic changes.

  • The largest change in the non-residential sector will occur in industry which is expected to increase its share of building construction to 15%, up 6% from a 1981 level of 9%.

- The commercial sector's market share will rise to account for 27% of building construction, up 3% from 1981 levels.

- Institutional and other buildings are not expected to have increased their 1981 market shares by much in 1991 rising only 1% and 2% respectively over the ten year period.

% Distribution of Building Construction
1971 - 1991

Sector	1971	1981	1991
Residential	53	53	41
Industrial	11	9	15
Commercial	15	24	27
Institutional	16	8	9
Other	5	6	8

Source: Construction Industry Development Council

- Given the long term trends a rough estimate of window usage in new non-residential construction can be made using the same growth rates predicted to occur in the various sectors.

Total window usage in new construction should be approximately 10.2 million sq ft in 1990, however if structural glazing (the "all-glass look") continues to accelerate these estimates are on the low side.

- Industrial construction will grow 35% over 1984 levels and;

- Commercial and institutional development will grow approximately 13%.

Projected Window Area in New Non-Residential Buildings
1990
(000 sq ft)

Building type	Window area
Commercial	6,600
Institutional	2,700
Industrial	900
TOTAL	10,200

- Renovation activity in the non-residential sector should increase as buildings need to be modernized; however the gains will not be as substantial as in the residential renovation sector.

MARKET PROFILE: U.S.

NON-RESIDENTIAL CONSTRUCTION

- From 1980 - 1984, the total value of non-residential construction rose by 28%.

Total Value of Non-Residential Construction
By Building Type
(millions of current $)

	1980	1981	1982	1983	1984
Industrial	13,837	17,030	17,343	12,821	13,745
Commercial	29,945	34,248	37,284	35,793	48,107
Institutional	4,046	4,907	5,875	6,559	6,297
Total	47,828	56,185	60,502	55,173	68,149

Source: U.S. Department of Commerce.

- Financing of non-residential construction in 1984 was greatly aided by surging business profits and a record inflow of foreign capital.

- The fastest growing categories in the non-residential buildings sector were office buildings and other commercial structures.

- Contracts for commercial and institutional buildings, which account for over 80% of total non-residential floor area, increased by 18.5% in 1984.

- In 1984, this construction was concentrated in the South and the West:

% Distribution of Construction Contracts Awarded by Region 1984

Region	%
South	44
West	25
North Central	19
North East	12
	100

Source: AAMA Statistical Review

WINDOW MARKET IN NON-RESIDENTIAL CONSTRUCTION

- In 1984, 116.8 million sq ft of glass were used for the vision area of windows in new non-residential construction.

- Of this total,
  - Architectural windows accounted for just under 60%
  - Curtain walls represented 40%

Window Usage in Non-Residential Buildings
New Construction
(Vision area, Millions of sq ft)

	1983	1984
Architectural Windows	63.5	68.4
Curtain Wall*	45.0	48.4
Total	108.5	116.8

Source: AAMA 1984 Statistical Review

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* Curtain wall figures include only transparent window area and exclude opaque spandralglass and nonglass panels

Non-Residential Renovation and Alteration Market

- In 1984, the U.S. Department of Commerce reported the value of additions and alterations in non-residential construction at 17,941 billion dollars. This represents an increase of 54% over 1980 levels.

- The growth of renovation activities is reflected in the number of windows used in remodeling and replacement applications.

- Window usage for this sector stood at 98.8 million sq ft in 1984. This is an increase of 9% over the previous year and represents just over 45% of the total non-residential market

Remodeling and Replacement Window Usage in Non-Residential Buildings (Vision area, millions of sq ft)

Window type	1983	1984
Architectural Windows	76.6	83.5
Curtain Wall	14.0	15.3
Total	90.6	98.8

Source: AAMA 1984 Statistical Review.

GLAZING AND FRAMES

- The use of sealed insulated glass in non-residential construction has increased from 35% of window area in 1978 to 53% in 1984.

  o This increase in penetration is expected to continue but at a slower rate as energy costs moderate

- Tinted glass was used in 52% of the non-residential market, while reflective glass was used in 21%.

- In curtain wall systems:

  - 4% used four-sided stopless glazing
  - 13% used two-sided stopless glazing
  - 83% used conventional glazing

% Glass Usage in Architectural Windows and Curtain Walls 1982

Window material	Architectural windows	Curtain walls
Annealed Glass	82	65
Tempered Glass	15	24
Laminated Glass	--	8
Plastics	3	3
Total	100	100

Source: Ducker Research Company

Long term trends

- It is estimated that from 1984 - 1989, private non-residential construction will grow at an average annual rate of 5%.

- Publicly-owned construction in real terms will grow 10%* over the same period. However, most construction other than military and highways is expected to decline in inflation adjusted terms.

- Industrial construction is likely to be the fastest growing market over the next five years. The most important factors in the optimistic long-term forecast for industrial construction are:

  - The solid rate of growth forecast for the U.S. economy;

  - The need to modernize existing facilities;

  - The general improvement in U.S. competitiveness resulting from forecasted decline in the foreign exchange value of the $U.S.

- The long term office building boom which began in 1976 is nearing an end and construction starts will probably decline over the next 2 years but will pick up towards the end of the decade

- Growth in construction of commercial buildings other than office buildings should continue to be strong until the 1990's

- Construction of hospitals and other institutional buildings is expected to grow after 1990's due to the increasing number of people entering the 65 and over age bracket.

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* Assuming latest 5 year budget proposal adopted
Assuming average annual 5% increase in construction costs

WINDOW MARKET
Long-Term Trends

- Forecasts by the Ducker Research Company indicate that by 1987 window sales to the non-residential sector will be approximately 137.6 million sq ft of vision area.

- The overall increase in the window market by 1987 is expected to be some 18% over 1984 although the number of sq ft used for curtain walls will drop. According to the 1987 forecast:

  - 80.6 million sq ft of window vision area will be used for architectural windows;
  - 57.0 million sq ft of vision area will be used for curtain walls.

- Non-residential contract awards for commercial and institutional buildings are expected to decline by 4% over the 1984-1987 period implying a drop in the new construction window market for these building types.

- Manufacturing and other non-residential contract awards however, will increase 2.3% and will pick up some of the slack registered by other sectors.

Projected Window Usage in Non-Residential Buildings
(Vision area, Millions of sq ft)

New construction	1985	1986	1987
Architectural	82.4	85.5	80.6
Curtain wall	58.3	60.5	57.0
Total	140.7	146.0	137.6

Source: AAMA 1984 Statistical Review

Renovation

- The renovation of existing buildings continues to increase:

  - It is expected that by 1987 remodeling and replacement applications will hold approximately 48% of the total window market with almost 128 million sq ft.

  - Replacement applications are particularly high in the Northeast primarily because expansion in production and distribution capacity has been lured to the South and West while the stock of old (and consequently more likely to be in need of repair) buildings is concentrated in the North.

Projected Window Usage in Non-Residential Buildings
(Vision Area, Millions of sq ft)

Remodeling & replacement	1985	1986	1987
Architectural	91.0	99.2	108.1
Curtain wall	16.7	18.2	19.8
Total	107.7	117.4	127.9

Source: AAMA 1984 Statistical Review

IV. SUNSPACES

MARKET PROFILE: CANADA

- The total market for sunspaces in Canada up to the year 2000 is expected to be 125,000 units. There are currently some 31,250 already in place at an average size of 3mx5m of floor area.

  • The market is divided into 2 categories:

  . Contractor built (all glass box) (20%) in which a higher percentage of glazed glass is used. Some 25,000 units are forecast;

  . Owner built (80%) which has a solid high wall and therefore uses about 1/2 as much glazing as the contractor built sunspace. Some 100,000 units are forecast.

- The forecast market for the year 2000 is shown below:

Forecast Sunspace Market Canada
by Type of Structure
Year 2000

	Contractor built	Owner built
Wood frame and sealed glass units	50%	60%
Aluminum frame and sealed glass units	30%	---
Other (Aluminum and plastic)	20%	40%
TOTAL	100%	100%

Source: Michael Dorgan (Glazed Structure Consultant, Ottawa).

- Current sunspaces are typically operated to be net energy savers and if the trend continues toward the all-glass look, these estimates would be on the low side

1 Contractor built includes prefabricated kits

MARKET PROFILE: U.S.

- Sunspaces in the U.S. have become increasingly popular as consumer preferences, especially in new residential construction, exhibit a desire for skylights and glazed enclosures.

  - The total number of residential skylights installed anually increased from 600,000 units in 1982 to 920,000 in 1984 - an increase of 53% during the period.

- Also, the U.S. government recognizes "passive solar program" and provides tax credits of up to $4,000.00 for the construction of sunspaces which conform to certain requirements. This provides an added incentive for home owners to install these enclosures.

- In 1984 approximately 1 million sunspace units were put in place. The market is divided into:

  . Contractor built (40%)
  . Owner built (60%)

- The popularity of owner built sunspaces can in part be explained by the nature of kits which in the U.S. market have reached a very advanced stage.

  - Even builders prefer to work with kit manufacturers as a "kit" product reduces site erection time.

  - According to a consumer survey, preference for sunspaces is most marked in the $200,000-250,000 home price range.

- Traditionally one and two-family dwellings have provided an excellent market for sliding glass doors and skylights. They are expected to do the same for sunspaces.

  In 1982 the number of new dwelling units having at least one skylight or form of sloped glazing was:

  • 25% of single-detached units;

  • 33% of single-family attached units.

- The main regions where potential market growth for sunspaces is forecast are:

  • California, Florida and Texas.

- Use of sunspace components and material vary regionally in type style and application, however the overall tendencies are exhibited in the following chart:

Trends for Options in Sunspaces

Glazing	Framing systems	Finishes	Options
Laminated inner Lights overhead U.S. tempered High emittance & reflective coatings H.R. translucent plastics Laminated curves	Microlaminated wood rafter bar and purlin system Tandem aluminum extrusion thermal break	Tile floors Movable shading systems/insulation/screens	Continuous operable ridge sash Operable skylights sliding door & patio door Heat storage devices Thermal control devices

Source: Steven Winter Associates Inc. (Architectural Engineering firm)

Long-term Trends

- The total market[1] for sunspaces up to the year 2000 is expected to be 2.5 million units of which 40% are already in place. About 1,000,000 units are estimated to be built by contractors, vs. some 1,500,000 units by home owners. The distribution by type of structure is forecast to be the same as that for the Canadian market.

- Builders' perspectives on skylights and glazed enclosures are quite favourable to the industry.

  - Builders have found that the inclusion of a sunspace has given them an edge in the marketplace with respect to investment.

  - When compared to a swimming pool as an option for a new home, a sunspace has a higher resale value while at the same time providing the home owner with year-round amenity and possible energy savings.

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1. Mr. Michael Dorgan (Glazed Structure Consultant)